REMARKS

Claims 4 and 7 are pending in the application.

The Present Invention

The present invention provides a low-noise transformer characterized in that the transformer core formed by laminating n pieces of electrical steel sheets has viscoelastic layers 30 μm or more in thickness inserted at random at m gaps among the n-1 gaps of laminated layers, m satisfying the formula: $3 \leq (n - 1) / m \leq 30$, wherein the viscoelastic layer has loss factor with one or more peaks at temperatures within a range from 20 to 200°C.

The formula: $3 \leq (n - 1) / m \leq 30$ represents a relationship between n and m when inserting a viscoelastic layer between m electrical steel sheets (less than n-1) within n-1 gaps of the laminated n electrical steel sheets. This formula (n-1/m) is determined to be 3 or more, because the space factor remarkably decreases if viscoelastic layers are inserted in the core at the ratio of one or more viscoelastic layers to three electrical steel sheet layers. (See specification, e.g., at page 7, lines 19-23). At the same time, (n-1/m) is determined to be 30 or less, because the absorption of vibration weakens if viscoelastic layers are inserted in the core at the ratio of one to 30. (See specification, e.g., at page 7, lines 23-27).

The reason why viscoelastic layers are inserted between the electrical steel sheets at unequal random layer intervals is to disperse the resonance frequencies and to avoid the amplification of vibration caused by the reasonance. (See specification, e.g., page 7, lines 28-31).

In the case of a design of a transformer, n is already given, and m is determined by the above mentioned formula considering resonance. The above mentioned formula may be rewritten as follows: $(n - 1) /30 \leq m \leq (n-1) /3$. For example, if 200

electrical steel sheets are stacked to form a transformer, $(200-1)/30 \leq m \leq (200-1)/3 \ldots 6.6 \leq m \leq 66.3 (\rightarrow 7 \leq m \leq 66)$. After this determination is made, the viscoelastic layers are inserted, e.g., as illustrated in Fig. 1 of the Attachment hereto, in accordance with the following procedure as an example.

1) Select an appropriate number within more than 7 to less than 66, and if 50 is selected,

2) Viscoelastic layers are inserted into 50 selected positions within 199 (200-1) gaps with different random intervals, i.e., unequal layer intervals. (See, e.g., specification page 7, line 36 to page 8, line 4).

3) There are several methods of inserting viscoelastic layer to those positions with a random interval, such as following way,

inserting viscoelastic layer in a random interval, such as in an order of;

below the second sheet from the surface, below the next third sheet, below the next forth sheet, further below the next second sheet, below the next third sheet, below the next forth sheet, and thereafter repeating.

See Fig. 1 of the Attachment hereto.

This is one example of using the formula of claim 4 for random insertion of the viscoelastic layers between the electrical steel sheets in accordance with the present invention.

§112

Claims 4 and 7 were rejected under 35 U.S.C. §112, second paragraph, as being indefinite.

The Office Action requested clarification of the random of the viscoelastic layers.

In view of the above explanation of the present invention, it is respectfully requested that the rejection under 35 U.S.C. §112, second paragraph, be withdrawn.

Random insertion of the viscoelastic layers means that the insertion of the viscoelastic layers in the (n-1) gaps is not an insertion at the same interval for each insertion.

With reference to the comments in the Office Action at page 4, first paragraph, it is submitted that even though the number of viscoelastic layers is defined in a range "m" defined by the formula of claim 4, the insertion of the "m" viscoelastic layers in the "(n-1)" gaps is still random, i.e., a random or unequal interval as opposed to a same interval. See again Fig. 1 of the Attachment hereto for one (1) example.

§103

Claims 4 and 7 were rejected under 35 U.S.C. §103(a) as being unpatentable over Japan No, 08-250339 to Arai et al. (the " '399 patent") in view of U.S. Patent No. 5,063,098 to Niwa et al. (the " '098 patent").

This rejection is respectfully traversed.

Patentability

The technology disclosed in '339 patent relates to a low-noise grain-oriented electromagnetic steel sheet laminated core, where the steel sheets are laminated into a laminated core interposing a resin intermediate layer, made from amorphous polyester or polyamide having viscoelasticity and having a thickness of less than 20 μm between the electrical steel sheets. However, it is difficult to reduce noise effectively for suppressing vibration perpendicular to the surfaces of the steel sheet in the '399 patent because of the thin thickness of resin intermediate layer and by inserting the viscoelastic layer at the same intervals, such as sheet-resin intermediate layer-sheet between each electrical steel sheet.

The formula of claim 4 and the random insertion are not disclosed or suggested in the '399 patent.

The technology disclosed in '098 patent relates to vibration damping materials and soundproofing structures using such damping materials, where a vibration damper includes two materials, each being formed of metal sheet having a rubber or synthetic resin base viscoelastic polymeric layer or layers formed on one or both sides, which are arranged in opposition to each other through the viscoelastic polymeric layer or layers formed on one or both side, which are arranged in opposition to each other through the viscoelastic polymeric layers and bonded together with the use of a hot-melt-adhesive synthetic resin layer having a high melting point. However, '098 patent cannot solve a problem of reduction of noise caused by a transformer.

The '098 patent is not directed to transformers. The '098 patent does not disclose or suggest the formula of claim 4 and the random insertion.

As mentioned above, both of '339 patent and '098 patent do not disclose or suggest the technical characteristic feature of the present invention in which the viscoelastic layers are randomly inserted into the electrical steel sheet gaps at unequal intervals for reducing noise caused by a transformer.

It is therefore submitted that independent claim 4, and claim 7 dependent thereon, are patentable over Japan No. 08-250339 to Arai et al. in view of U.S. Patent No. 5,063,098 to Niwa et al.

CONCLUSION

It is submitted that in view of the foregoing remarks, the application is now in condition for allowance. It is therefore respectfully requested that the application be allowed and passed for issue.

Respectfully submitted,

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